International Standard 1708

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Acceptance conditions for general purpose parallel lathes — Testing of the accuracy

Conditions de réception des tours parallèles d'usage général — Contrôle de la précision

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1708 was developed by Technical Committee ISO/TC 39, *Machine tools.*

This third edition was submitted directly to the ISO Council, in accordance with clause 6.11.2 of part 1 of the Directives for the technical work of ISO. It cancels and replaces the second edition (i.e. ISO 1708-1979), which had been approved by the member bodies of the following countries :

Australia	India	South Africa, Rep. of
Austria	Israel	Spain
Belgium	Italy	Sweden
Brazil	Japan	Switzerland
Chile	Korea, Rep. of	Thailand
Czechoslovakia	Netherlands	Turkey
France	New Zealand	United Kingdom
Germany, F.R.	Poland	USA
Greece	Portugal	
Hungary	Romania	

No member body had expressed disapproval of the document.

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Acceptance conditions for general purpose parallel lathes — Testing of the accuracy

1 Scope and field of application

This International Standard describes, with reference to ISO/R 230, both geometrical and practical tests on general purpose parallel lathes, and gives the corresponding permissible deviations which apply.

It deals only with the verification of accuracy of the machine. It does not apply to the testing of the running of the machine (vibrations, abnormal noises, stick-slip motion of components, etc.), or to characteristics (speeds, feeds, etc.,) which should generally be checked before testing accuracy.

2 Reference

ISO/R 230, *Machine tool test code.*

3 Preliminary remarks

3.1 In this International Standard, all the dimensions are expressed in millimetres and in inches.

3.2 To apply this International Standard, reference shall be made to ISO/R 230, especially for installation of the machine before testing, warming up of spindles and other moving parts, description of measuring methods and recommended accuracy of testing equipment.

3.3 The sequence in which the geometrical tests are given is related to the sub-assemblies of the machine, and this in no way defines the practical order of testing. In order to make the mounting of instruments or gauging easier, tests may be applied in any order.

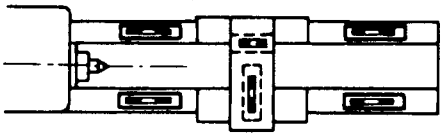
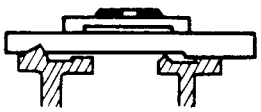
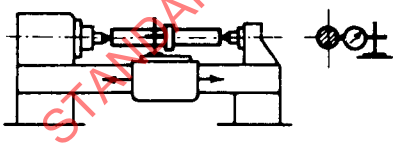
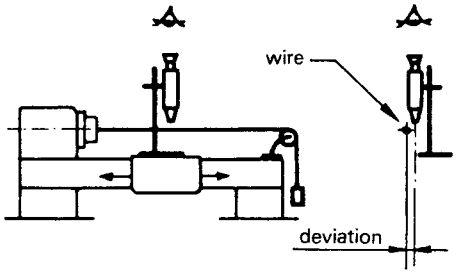
3.4 When inspecting a machine, it is not always necessary to carry our all the tests given in this International Standard. It is up to the user to choose, in agreement with the manufacturer, those relating to the properties which are of interest to him, but the agreed tests shall be clearly stated when ordering a machine.

3.5 Practical tests should be made with finishing cuts — for instance, depth = 0,1 mm (0.004 in); feed = 0,1 mm (0.004 in) per revolution — and not with roughing cuts, which are liable to generate appreciable cutting forces.

3.6 When establishing the tolerance for a measuring range different from that indicated in this International Standard (see clause 2.311 in ISO/R 230) it should be taken into consideration that the minimum value of tolerance is 0,005 mm (0.0002 in) for precision lathes and 0,010 mm (0.0004 in) for other lathes.

4 Acceptance conditions and permissible deviations

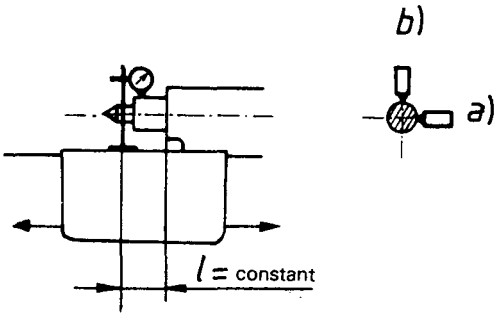
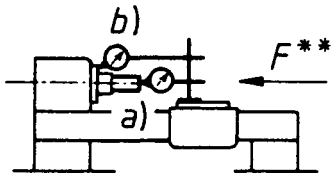
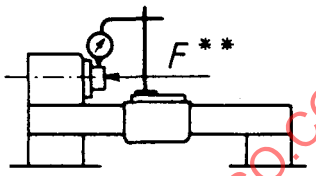
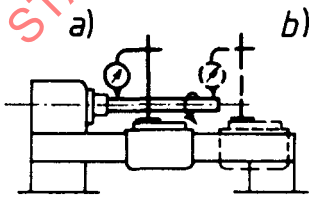
4.1 Geometrical tests

No.	Diagram	Object	Precision lathes	
			mm	in
			D_a < 500 and DC < 1500	D_a < 20 and DC < 60
G1	a) 	**A — Bed** Verification of levelling of slideways *a)* Longitudinal verification: Straightness of slideways in the vertical plane.	DC < 500 0,01 (convex)	DC < 20 0.0004 (convex)
			500 < DC < 1000 0,015 (convex) Local tolerance**: 0,005 for any length of 250	20 < DC < 40 0.0006 (convex) Local tolerance**: 0.0002 for any length of 10
			1000 < DC < 1500 0,02 (convex) Local tolerance**: 0,005 for any length of 250	40 < DC < 60 0.0008 (convex) Local tolerance**: 0.0002 for any length of 10
	b) 	*b)* Transverse verification: Slideways should be in the same plane.	*b)* Variation of level: 0,03/1000	*b)* Variation of level: 0.0012/40
G2	a) 	**B — Carriage** Checking of straightness of carriage movement in a horizontal plane or, possibly, in a plane defined by the axis of the centres and the tool point.	DC < 500 0,01	DC < 20 0.0004
			500 < DC < 1000 0,015	20 < DC < 40 0.0006
	b) 		1000 < DC < 1500 0,02	40 < DC < 60 0.0008

* DC = distance between centres.
D_a = maximum permissible diameter above the bed.

** See clause 5.

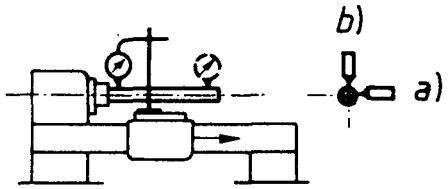
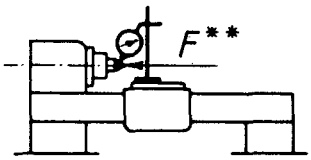
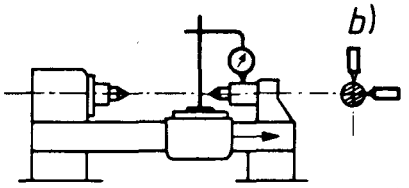
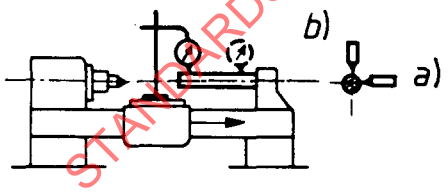
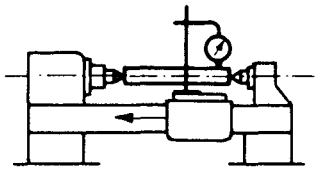
Permissible deviation*				Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes					
mm		in			
$D_a < 800$	$800 < D_a < 1600$	$D_a < 32$	$32 < D_a < 64$		
$DC < 500$		$DC < 20$		Precision levels, optical or other methods	a) Clauses 3.11, 3.21, 5.212.21 and 5.212.22 Make the measurements at a number of positions equally spaced along the length of the bed. The levels may be placed on the transverse slide. When the slideways are not horizontal, use a special straightedge as mentioned in figure 12 of clause 5.212.21 (2°).
0,01 (convex)	0,015 (convex)	0.0004 (convex)	0.0006 (convex)		
$500 < DC < 1000$		$20 < DC < 40$			
0,02 (convex)	0,03 (convex)	0.0008 (convex)	0.0012 (convex)		
Local tolerance**:		Local tolerance**:			
0,0075	0,01	0.0003	0.0004		
for any length of 250		for any length of 10			
$DC > 1000$		$DC > 40$			
For each 1000 increase in distance between centres beyond 1000, add to the corresponding preceding tolerance:		For each 40 increase in distance between centres beyond 40, add to the corresponding preceding tolerance:			
0,01	0,02	0.0004	0.0008		
Local tolerance**:		Local tolerance**:			
0,015	0,02	0.0006	0.0008		
for any length of 500		for any length of 20			
b) Variation of level:		*b)* Variation of level:		Precision levels	*b)* Clause 5.412.7 Place a level transversely on the slideways and take measurements at a number of positions equally spaced along the length of the slideways. The variation of level measured at any position shall not exceed the permissible deviation.
0,04/1000		0.0016/40			
$DC < 500$		$DC < 20$		*a)* For DC < 1500 mm (60 in) dial gauge and mandrel between centres of straightedge	*a)* Clause 5.232.3*a)* or 5.232.1 Touch the front generatrix of the mandrel (instead of the mandrel, a straightedge with parallel faces may be used). Length of mandrel between centres shall be as nearly as possible equal to the value of *DC*.
0,015	0,02	0.0006	0.0008		
$500 < DC < 1000$		$20 < DC < 40$			
0,02	0,025	0.0008	0.0010		
$DC > 1000$		$DC > 40$		*b)* Whatever the value of *DC*, taut wire and microscope or optical methods	*b)* Clauses 5.212.3 and 5.232.3*b)* The deviation of straightness of carriage movement shall, other than in exceptional cases, be concave relative to the axis of the centres.
For each 1000 increase in distance between centres beyond 1000, add to the corresponding preceding tolerance:		For each 40 increase in distance between centres beyond 40, add to the corresponding preceding tolerance:			
0,005		0.0002			
Maximum permissible deviation:		Maximum permissible deviation:			
0,03	0,05	0.0012	0.0020		

No.	Diagram	Object	Precision lathes	
			mm	in
			D_a < 500 and DC < 1500	D_a < 20 and DC < 60
G3		Checking of parallelism of tailstock to carriage movements: *a)* in the horizontal plane; *b)* in the vertical plane.	*a)* 0,02 Local tolerance: 0,01 for any length of 500 *b)* 0,03 Local tolerance: 0,02 for any length of 500	*a)* 0.0008 Local tolerance: 0.0004 for any length of 20 *b)* 0.0012 Local tolerance: 0.0008 for any length of 20
G4		**C — Headstock spindle** *a)* Measurement of periodic axial slip. *b)* Measurement of camming of the face plate resting surface.	*a)* 0,005 *b)* 0,01 including periodic axial slip	*a)* 0.0002 *b)* 0.0004 including periodic axial slip
G5		Measurement of run-out of spindle nose centring sleeve	0,007	0.0003
G6		Measurement of run-out of axis of centre: *a)* at the spindle nose of the housing; *b)* at a distance from the spindle nose equal to $\frac{D_a}{2}$ or not more than 300 mm (12 in)[1].	*a)* 0,005 *b)* 0,015 for a measuring length of 300 0,01 for a measuring length of 200 0,005 for a measuring length of 100	*a)* 0.0002 *b)* 0.0006 for a measuring length of 12 0.0004 for a measuring length of 8 0.0002 for a measuring length of 4

* DC = distance between centres.
D_a = maximum permissible diameter above the bed.

** F = constant pressure on spindle to eliminate axial bearing end play.

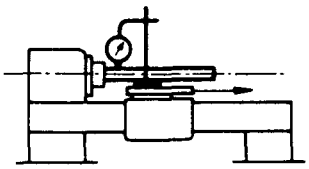
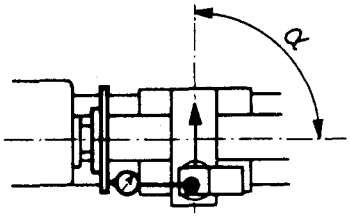
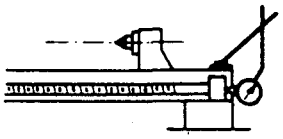
Permissible deviation*				Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes					
mm		in			
$D_a < 800$	$800 < D_a < 1600$	$D_a < 32$	$32 < D_a < 64$		
$DC < 1500$ *a*) and *b*) 0,03	$DC < 1500$ *a*) and *b*) 0,04	$DC < 60$ *a*) and *b*) 0.0012	$DC < 60$ *a*) and *b*) 0.0016	Dial gauge	Clause 5.422.5 With the tailstock as close as possible to the carriage take the readings when both are moved together; keep the tailstock sleeve locked so that the dial gauge fixed on the carriage always touches the same point.
Local tolerance: 0,02 for any length of 500		Local tolerance**: 0.0008 for any length of 20			
$DC > 1500$ *a*) and *b*) 0,04 Local tolerance: 0,03 for any length of 500		$DC > 60$ *a*) and *b*) 0.0016 Local tolerance: 0.0012 for any length of 20			
a) 0,01 *b*) 0,02 including periodic axial slip	*a*) 0,015 *b*) 0,02 including periodic axial slip	*a*) 0.0004 *b*) 0.0008 including periodic axial slip	*a*) 0.0006 *b*) 0.0008 including periodic axial slip	Dial gauge and, possibly, a special device	Clauses 5.62, 5.621.2, 5.622.2 and 5.632 For the position of the dial gauge, see figures 59 to 64 and 67 of clauses 5.62, 5.622 and 5.632. The value of force F to be applied for the tests *a*) and *b*) shall be specified by the manufacturer.
0,01	0,015	0.0004	0.0006	Dial gauge	Clauses 5.612.2 and 5.621.2 The value of force F to be applied shall be specified by the manufacturer. In the case of a tapered spindle nose, fix the dial gauge perpendicular to the generating line of the taper.
a) 0,01 *b*) 0,02 for a measuring length of 300	*a*) 0,015 *b*) 0,05 for a measuring length of 500	*a*) 0.0004 *b*) 0.0008 for a measuring length of 12	*a*) 0.0006 *b*) 0.0020 for a measuring length of 20	Dial gauge and test mandrel	Clause 5.612.3 1) For lathes such that $D_a > 800$ mm (32 in), the measuring length might be increased up to 500 mm (20 in).

No.	Diagram	Object	Precision lathes	
			mm	in
			D_a < 500 and DC < 1500	D_a < 20 and DC < 60
G7		Checking of parallelism of spindle axis to carriage longitudinal movement on a length equal to $\frac{D_a}{2}$ or a maximum equal to 300 mm (12 in)[1]: *a)* in the horizontal plane; *b)* in the vertical plane.	*a)* 0,01/300 frontwards *b)* 0,02/300 upwards	*a)* 0.0004/12 frontwards *b)* 0.0008/12 upwards
G8		Measurement of run-out of centre.	0,01	0.0004
G9		**D — Tailstock** Checking of parallelism of the axis of the outside of tailstock sleeve to carriage movement: *a)* in the horizontal plane; *b)* in the vertical plane.	*a)* 0,01/100 frontwards *b)* 0,015/100 upwards	*a)* 0.0004/4 frontwards *b)* 0.0006/4 upwards
G10		Checking of parallelism of taper bore of sleeve to carriage movement on a length equal to $\frac{D_a}{4}$ or a maximum equal to 300 mm (12 in)[1]: *a)* in the horizontal plane; *b)* in the vertical plane.	*a)* 0,02/300 frontwards *b)* 0,02/300 upwards	*a)* 0.0008/12 frontwards *b)* 0.0008/12 upwards
G11		**E — Centres** Checking of difference in height between headstock and tailstock centres.	0,02 Tailstock centre higher than headstock centre	0.0008 Tailstock centre higher than headstock centre

* DC = distance between centres.
D_a = maximum permissible diameter above the bed.

** F = constant pressure on spindle to eliminate axial bearing end play.

Permissible deviation*				Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes					
mm		in			
$D_a \leq 800$	$800 < D_a \leq 1600$	$D_a \leq 32$	$32 < D_a \leq 64$		
a) 0,015/300 frontwards b) 0,02/300 upwards	a) 0,03/500 frontwards b) 0,04/500 upwards	a) 0.0006/12 frontwards b) 0.0008/12 upwards	a) 0.0012/20 frontwards b) 0.0016/20 upwards	Dial gauge and test mandrel	Clauses 5.412.1 and 5.422.3 1) For lathes such that $D_a > 800$ mm (32 in), the measuring length might be increased up to 500 mm (20 in).
0,015	0,02	0.0006	0.0008	Dial gauge	Clauses 5.612.2 and 5.621.2 The dial gauge being placed perpendicularly to the taper surface of the head centre, and tolerance being given in a plane perpendicular to the spindle axis, divide the readings observed by cos α, α being the semi cone angle of the taper. The value of force F to be applied shall be specified by the manufacturer.
a) 0,015/100 frontwards b) 0,02/100 upwards	a) 0,02/100 frontwards b) 0,03/100 upwards	a) 0.0006/4 frontwards b) 0.0008/4 upwards	a) 0.0008/4 frontwards b) 0.0012/4 upwards	Dial gauge	Clause 5.422.3 After the tailstock sleeve has been sufficiently extended, it shall be locked as under normal working conditions.
a) 0,03/300 frontwards b) 0,03/300 upwards	a) 0,05/500 frontwards b) 0,05/500 upwards	a) 0.0012/12 frontwards b) 0.0012/12 upwards	a) 0.0020/20 frontwards b) 0.0020/20 upwards	Dial gauge and test mandrel	Clause 5.422.3 Lock the tailstock sleeve as under normal working conditions. 1) For lathes such that $D_a > 800$ mm (32 in), the measuring length might be increased up to 500 mm (20 in).
0,04 Tailstock centre higher than headstock centre	0,06	0.0016 Tailstock centre higher than headstock centre	0.0024	Dial gauge and test mandrel	Clause 5.422.3 Touch the top generatrix of the mandrel. Take readings as the extremities of the test mandrel with the tailstock and tailstock sleeve locked, as under normal working conditions.

No.	Diagram	Object	Precision lathes	
			mm	in
			D_a < 500 and DC < 1500	D_a < 20 and DC < 60
G12		**F — Upper slide** Checking of parallelism of the longitudinal movement of the upper slide to the spindle axis.	0,015/150	0.0006/6
G13		**G — Cross slide** Measurement of squareness of the transverse movement of the cross slide to the spindle axis.	0,01/300 Direction of deviation: $\alpha > 90°$	0.0004/12 Direction of deviation: $\alpha > 90°$
G14		**H — Lead screw** Measurement of periodic axial slip due to camming of each thrust bearing.	0,01	0.0004
G15		Checking of the cumulative error generated by the lead screw.	*a)* 0,03 for any measured length of 300 *b)* 0,01 for any measured length of 60	*a)* 0.0012 for any measured length of 12 *b)* 0.0004 for any measured length of 2.4

• DC = distance between centres.
D_a = maximum permissible diameter above the bed.

Permissible lathes*				Measuring instruments	Observations and references to the test code ISO/R 230
Other lathes					
mm		in			
$D_a < 800$	$800 < D_a < 1600$	$D_a < 32$	$32 < D_a < 64$		
0,04/300		0.0016/12		Dial gauge and test mandrel	Clause 5.422.3 Make the measurement in the vertical plane (after setting up the upper slide parallel with the spindle axis in the horizontal plane), only in the working position of the upper slide.
0,02/300 Direction of deviation: $\alpha > 90°$		0.0008/12 Direction of deviation: $\alpha > 90°$		Dial gauge and flat disk or straight-edge	Clauses 5.522.3 and 3.22
0,015	0,02	0.0006	0.0008	Dial gauge	Clauses 5.622.1 and 5.622.2 This operation may be deleted if practical test P3 is carried out.
$DC < 2000$ *a)* 0,04 for any measured length of 300 $DC > 2000$ For each 1000 increase in distance between centres beyond 2000, add to the corresponding preceding tolerance: 0,005 Maximum permissible deviation: 0,05 *b)* 0,015 for any measured length of 60		$DC < 80$ *a)* 0.0016 for any measured length of 12 $DC > 80$ For each 40 increase in distance between centres beyond 80, add to the corresponding preceding tolerance: 0.0002 Maximum permissible deviation: 0.0020 *b)* 0.0006 for any measured length of 2.4			Clauses 6.1 and 6.2 *Precision lathes.* A record of the pitch accuracy will be made by means of an electric pick-up, for instance, feeling the flanks of the threads of a master lead screw of 300 mm (12 in) length held between centres. *Other lathes.* Length bars will be used associated with a dial gauge so as to compare the carriage travel to the number of corresponding revolutions of the spindle. However, for both classes of lathes, a record of the lead screw accuracy (over a specified length and checked along four generators shifted 90° forward) should be satisfactory. NOTE — By agreement between manufacturer and used on the measuring method and the values of the permissible deviation, total error may be checked over 300 mm.